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DIGITAL AMERICA: A TALE OF THE HAVES AND HAVE-MORES

DECEMBER 2015

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DIGITAL AMERICA: A TALE OF THE HAVES AND HAVE-MORES

DECEMBER 2015

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IN BRIEF

DIGITAL AMERICA: A TALE OF THE HAVES AND HAVE-MORES

The United States is digitizing so rapidly that most users are scrambling to adapt. The race to keep up with technology and put it to the most effective business use is producing digital "haves" and "have-mores"—and the large, persistent gap between them is becoming a decisive factor in competition across the economy.

- Digitization is happening unevenly, and users with advanced digital capabilities are capturing disproportionate benefits. The companies leading the charge are winning the battle for market share and profit growth; some are reshaping entire industries to their own advantage. But many businesses are struggling to evolve quickly enough. Workers in the most digitized industries enjoy wage growth that is twice the national average, while the majority of US workers face stagnant incomes and uncertain prospects.
- Digitization is not just about buying IT equipment and systems. The most explosive growth is now in usage as companies continue to integrate digital tools into an ever-widening variety of business processes. MGI's Industry Digitization Index is the first major effort to capture how this activity is playing out at the sector level. It compiles dozens of indicators to provide a picture of digital assets, usage, and workers across the economy. In addition to the information and communications technology (ICT) sector, media, financial services, and professional services are surging ahead, while others have significant upside to capture. In fact, most sectors across the economy are less than 15 percent as digitized as the leading sectors. Despite a great rush of adoption, this gap has barely narrowed over the past decade. We see this pattern at the company level as well as the sector level.
- Digitization is changing the dynamics in many industries. New markets are proliferating, value chains are breaking up, and profit pools are shifting. Businesses that rely too heavily on a single revenue stream or on playing an intermediary role in a given market are particularly vulnerable. In some markets, there is a winner-take-all effect. For companies, this is a wake-up call—and an opportunity to reinvent every process with a fresh focus on the customer.
- As digitization accelerates, the United States has a major opportunity to boost productivity growth. Looking at just three big areas of potential—online talent platforms, big data analytics, and the Internet of Things—we estimate that digitization could add up to $2.2 trillion to annual GDP by 2025, although the possibilities are much wider. Some of the sectors that are currently lagging could be poised for rapid growth. Companies in manufacturing, energy, and other heavy industries are investing in digitizing their extensive physical assets, bringing us closer to the era of connected cars, smart buildings, and intelligent oil fields.
- But there will also be more economic dislocation. As digital technologies automate many of the tasks that humans are paid to do, the day-to-day nature of work will change in a majority of occupations. As companies redefine many roles and business processes, workers of all skill levels will be affected. Historical job displacement rates could accelerate sharply over the next decade. The United States will need to adapt its institutions and training pathways to help workers acquire relevant skills and navigate this period of transition and churn.

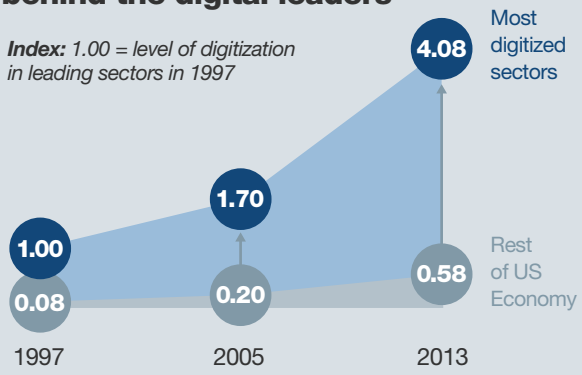
Today the race is on to capture value from data analytics and the Internet of Things, btut there is no finish line. Digitization involves continuously experimenting and adapting, whether the focus is on back-office processes, the customer experience, or the introduction of new products and services. It takes investment, agility, and relentless focus to stay ahead in this hypercompetitive new world, but there are outsized opportunities for the organizations and individuals that can establish themselves as digital leaders.

The accelerating digitization of the US economy

Digitization now touches most of the economy...

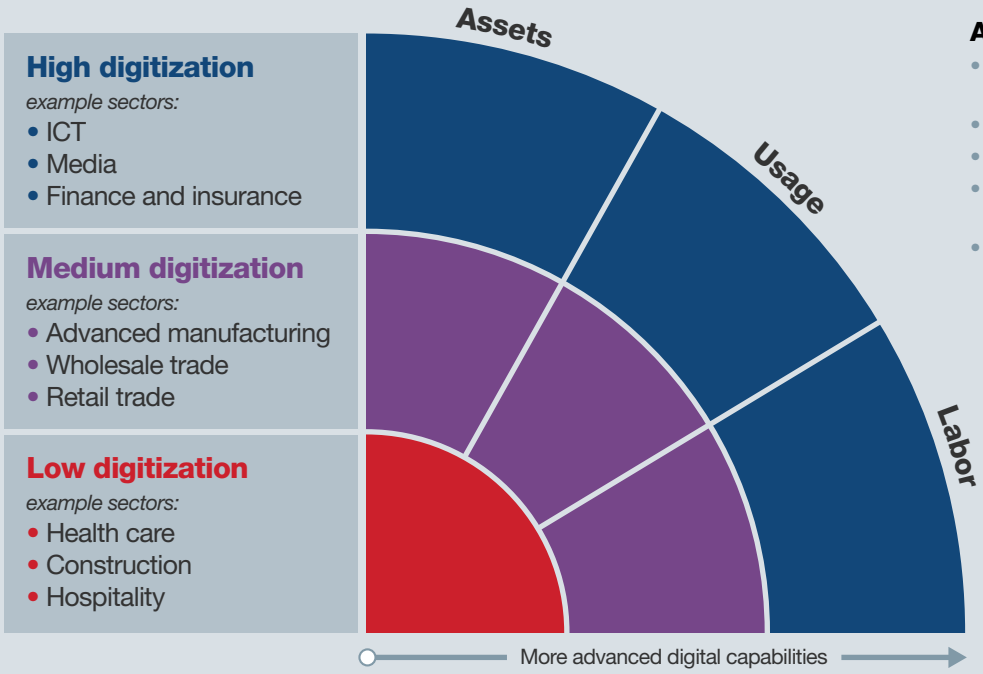
- **5%** Information and communications technology (ICT) as a share of GDP
- **28%** of payments are made digitally
- **64%** of adults use smartphones
- **84%** of adults use the Internet
- **98%** have access to high-speed Internet

...yet most sectors lag far behind the digital leaders



There is a large gap between the digital "haves" and "have-mores"

MGI's **Industry Digitization Index** combines 27 indicators to measure the digital assets, digital usage, and digital workers in each sector



Across industries:

- Digital assets create competitive advantage
- New intermediaries emerge
- Value chains break apart
- Winner-take-all dynamic develops
- Industry boundaries blur

As the digital frontier expands, there is constant pressure to **adapt and evolve**

Companies

- The digital leaders never stop inventing and experimenting; incumbents have to do the same. The biggest risk is being disrupted while sitting on the sidelines.
- Build a strong balance sheet of digital assets, and find a way to monetize consumer surplus.
- Use digital to reinvent every process and build a more customer-focused, productive organization.

Policy makers

- As more tasks can be automated, jobs at all skill levels will be redefined. New training pathways and institutional responses will be critical.
- The speed of innovation calls for a more agile, test-and-learn approach to regulation and policy.
- Government can expand participation by providing access and infrastructure, enhancing digital literacy, and digitizing its own services.

Digitization could add some **$2.2 trillion to annual GDP by 2025** in three areas alone—and this is only part of the potential

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EXECUTIVE SUMMARY

Digital innovation, adoption, and usage are evolving at a supercharged pace across the US economy. As successive waves of innovation expand the definition of what is possible, the most sophisticated users have pulled far ahead of everyone else in the race to keep up with technology and devise the most effective business uses for it.

There is a pronounced and persistent gap between the digital "haves" and "have-mores." The companies with advanced digital assets and capabilities are capturing market share and profit growth; the true disruptors are even gaining the ability to reshape industries to their own advantage. The "have-mores" are not just large companies that dominate one sector. They can be small, innovative firms or companies whose digital assets enable them to play in multiple sectors. In the labor force, the workers with the most sophisticated digital skills are the "have-mores"—and they command wages far above the national average. Meanwhile, there is a growing opportunity cost for the organizations and individuals that fall behind.

Because the digital frontier is expanding on many fronts simultaneously, it is surprisingly difficult to pin down the extent of digitization in the US economy with any single metric. The information and communications technology (ICT) sector supplies the devices, software, and services that are fueling this shift. But at 5 percent of US GDP in the measured statistics, it is only a sliver of a much broader phenomenon. Beyond the ICT sector itself, usage is exploding as companies build new types of digital assets and connect them in ways that sometimes overturn existing business models. They are engaging more deeply with customers and suppliers, putting powerful tools in the hands of employees, and even devising new ways of working. Digitization now touches most of the population and every sector of the economy.

MGI's Industry Digitization Index provides a snapshot of this activity at the sector level. It brings together dozens of indicators for a comprehensive picture of digital assets, usage, and workers across the economy. It reveals that some sectors are surging ahead, while others have significant upside to capture. We also quantify the considerable gap between the most digitized sectors and the rest of the economy over time. Despite a rush of adoption, most sectors have barely closed that gap over the past decade. This pattern is also apparent at the company level. Within many industries, there is a stark difference in digital capabilities between leading firms and average firms.

As companies learn how to get the most out of technology and usage deepens in additional industries, the United States has a major opportunity to address one of its most critical economic challenges: accelerating productivity growth. Digitization could also produce even greater consumer surplus and societal benefits in the future.

But strains in the labor market could worsen as technology develops the capabilities to perform more human tasks. An analysis of the tasks that can be automated by adapting currently demonstrated technologies shows that a majority of occupations, at all skill levels, are likely to be affected to some degree. Over the coming decade, companies will redefine many roles, and the rate of job displacement could accelerate sharply. Addressing a shift of this magnitude will require much more than a business-as-usual approach to skills development.

The digital frontier is uncharted territory, full of exciting possibilities for innovation and productivity. At the same time, it creates more competitive pressure and the potential for businesses without the best digital assets and capabilities to be disrupted. Companies are aiming at a moving target, but there is no opting out of the imperative to go digital. The opportunities and operational benefits are too great—and the biggest risk of all is being disrupted while sitting on the sidelines.

Box E1. A broad view of digitization: Assets, usage, and people

Many observers who have tried to quantify the impact of technology have focused exclusively on the ICT sector. Our analysis begins there, but its primary focus is on how deeply digital technologies are penetrating the rest of the economy and the myriad ways they are being used to create value.

Official GDP statistics do not reflect the ICT sector's role as the engine of digitization for the broader economy. Overall, the sector made up approximately 5 percent of US GDP in 2014, on par with the size of the retail sector. Surprisingly, this is down slightly from its peak of roughly 5.5 percent in 1997. This decline, which seems at odds with two decades of rapid adoption, is partly due to the fact that prices for ICT goods and services tumbled by 63 percent between 1983 and 2010, even as the price of other durable goods and services steadily increased. More powerful and sophisticated technology became affordable for users across the economy, greatly benefiting companies in other sectors that purchase ICT goods and services. If we account for the price decline in ICT and its benefit to other sectors, adjusting for price elasticity of demand, the ICT sector would represent some 10 percent of US GDP in 2014.

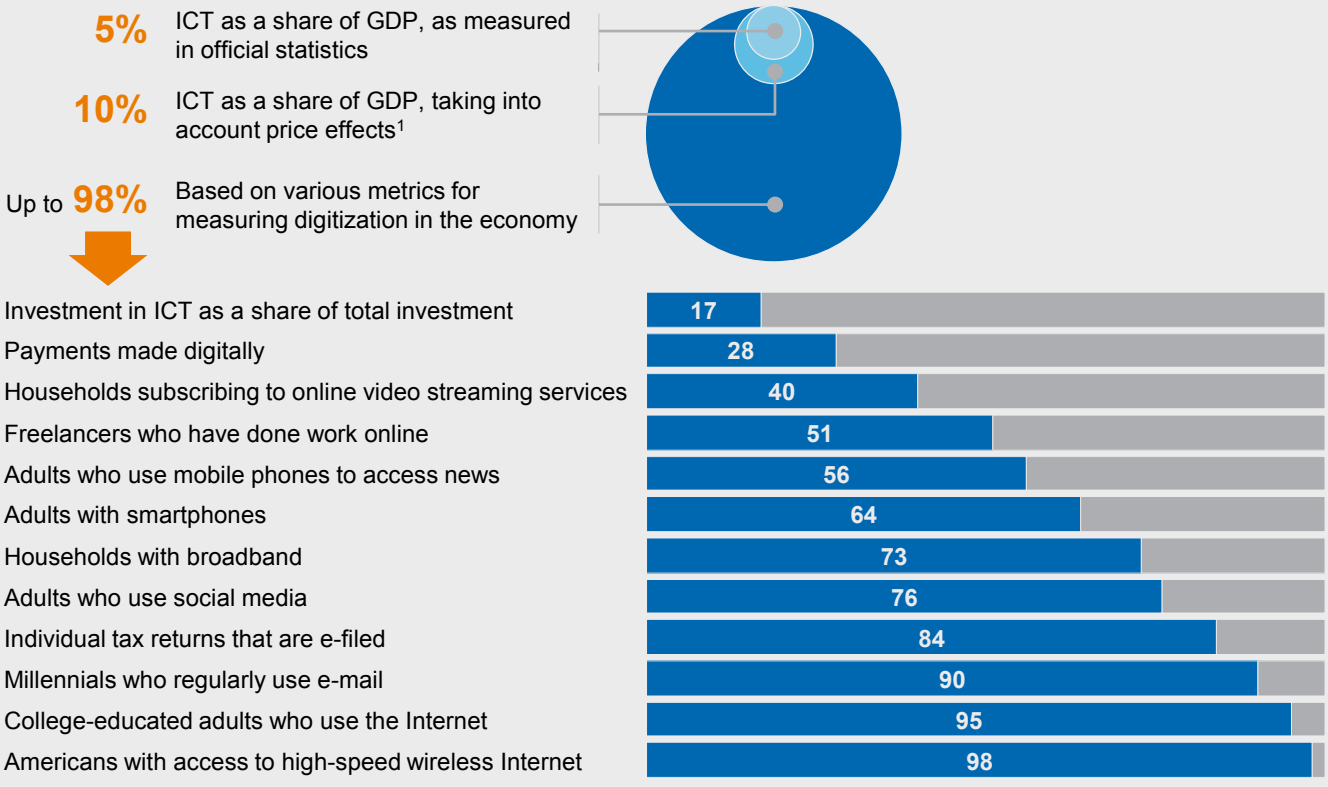
But even this adjustment does not capture the magnitude of technology's impact. Digitization, like electricity, is a general-purpose technology that underpins a huge share of economic activity beyond the sector that supplies it (Exhibit E1). More than two-thirds of US adults have smartphones, for example, and the shift toward mobile has led to skyrocketing usage in areas from e-commerce and digital payments to social media engagement.

Because there is no single way to measure such a complex and diffuse phenomenon, we need a view based on how various sectors are deepening digital assets, expanding digital usage, and creating a more digitally enabled workforce. The MGI Industry Digitization Index, which forms the heart of this research, offers a snapshot of how various parts of the economy are evolving along these three dimensions.

Exhibit E1

Digitization now touches most Americans and most of the US economy

Share of US economy impacted by digitization
Various metrics, 2014 or latest



1 Factoring in real price declines in ICT goods and estimating the benefits to non-ICT sectors based on their ICT purchases, adjusting for price elasticity of demand.

SOURCE: BEA; BLS; Pew Research Center; the White House; Nielsen; IRS; US Census Bureau; McKinsey social technology survey; McKinsey Payments Map; McKinsey Global Institute analysis

THE DIGITAL FRONTIER IS RAPIDLY EVOLVING, AND THOSE AT THE FOREFRONT CAPTURE DISPROPORTIONATE REWARDS

Digitization has advanced in a series of accelerating waves that touch more and more participants. As each one builds on and amplifies what has come before, the waves are hitting in faster succession and with greater impact. Today the focus is on connectivity, platforms, data, and software. These spread faster than classic computing hardware due to their network effects and the marginal cost economics associated with products and services in digital rather than physical form. Together these technologies have set off a virtuous cycle of innovation as they are combined and recombined in the form of new products. As consumers see the benefits and are quicker to adopt, businesses can take advantage of a built-in audience for yet more innovation.

For decades, digital innovation was focused on expanding business usage through advances such as enterprise software for managing operations. But beginning in the mid-1990s and especially over the past decade, the US digital transformation moved in new directions. The Internet, mobile connectivity, social media, and smartphone apps created a massive spike in consumer adoption. Meanwhile, businesses have steadily continued to invest. Today they are stepping into the age of analytics, using technology to analyze enormous troves of data for insights that can inform decisions and generate business insights. The Internet of Things can improve the utilization of machinery, boost the output of oil fields, and make buildings more efficient, potentially delivering a significant boost to productivity in the decade ahead. Even bigger possibilities are on the horizon with advances in artificial intelligence and new applications of digital technologies in fields such as synthetic biology.

The gap between those on the frontier and the rest of the economy is about the sophistication of digital usage. Much has been written over the years about the digital divide and the Americans who remain offline, but now a new and more pervasive dynamic appears to be at work. The gap between the digital "haves" and "have-mores" is growing as the most advanced users pull away from everyone else. They have moved beyond expanding access and adding users; now they are focused on deepening engagement and capabilities.

This gap between the "haves" and "have-mores" increasingly defines corporate competition in the United States. While it may seem that most companies went digital long ago, most are using only a fraction of the capabilities associated with technology and are far behind the digital leaders in using those tools to transform their core processes and customer relationships. In contrast, a small group of sectors, organizations, and individuals are far ahead of the curve.

The digital frontier is a high-risk, high-reward environment. At a broad level, the industries with the fastest profit margin growth tend to be those with the fastest growth in software intensity. And *within* these sectors, the margin spreads between the top-performing companies and the lowest performers are two to four times those in other sectors. In other words, the most digitized industries are developing a winner-take-all dynamic. But at the same time, digitization seems to intensify competitive churn.[1] Today's market leaders are vulnerable to being knocked off by the next wave of innovation.

[1] Andrew McAfee and Erik Brynjolfsson, "Investing in the IT that makes a competitive difference," *Harvard Business Review*, July-August 2008.

The same pattern affects individuals as well as the corporate sector. One study found that only 20 percent of individual users capture 60 percent of all consumer surplus, while the bottom 50 percent capture just 20 percent.[2] The typical person who uses a smartphone for communication, entertainment, or basic searches is not taking advantage of the full range of applications that produce real efficiencies. For workers, wage growth has been approximately twice as fast as the national average in the most highly digitized industries, such as ICT and professional services. Within these fields, too, a small group of workers at the leading edge command sharply higher compensation. Conversely, those who lack digital skills face narrowing job prospects.

SOME INDUSTRIES AND COMPANIES ARE MORE DIGITIZED THAN OTHERS

There is no single formula for going digital. Companies that buy ICT assets may assume they have made the leap and the benefits will start to flow. But the real value lies in combining digital assets and capabilities with ingenuity. It involves using these tools to engage with customers, to create new products and business models, and to improve operations. This process is happening unevenly, however, with some companies and some sectors pulling far ahead of the pack. Measuring this activity in various sectors requires a multidimensional view.

27
indicators show how companies and industries are digitizing

The MGI Industry Digitization Index examines sectors across the economy through the lens of digital assets, digital usage, and digital workers, compiling 27 indicators to capture the many possible ways in which companies are digitizing. To measure digital assets, for instance, we consider business spending on computers, software, and telecom equipment, as well as the stock of ICT assets, the share of assets such as robots and cars that are digitally connected, and total data storage. Usage metrics include an industry's use of digital payments, digital marketing, and social technologies, as well as the use of software to manage both back-office operations and customer relationships. On the workforce side, we evaluate more than 12,000 detailed task descriptions to identify those associated with digital technologies (such as database administration). We also estimate the share of workers in each sector in technology-related occupations that did not exist 25 years ago, and we determine digital spending and assets on a per-worker basis.

The index shows that the US economy is digitizing unevenly, with large disparities among sectors (Exhibit E2). Beyond the ICT sector, which often sets the standard for the highest level of digitization on various indicators, the most highly digitized parts of the economy are media, professional services, and financial services.

The index also highlights where there is room for growth in digital capabilities. Utilities, mining, and manufacturing, for example, are in the early stages of digitizing and connecting their physical assets, and they could be at the forefront of the next wave of digitization. Labor-intensive industries such as retail and health care are expanding digital usage, but substantial parts of their large workforces do not use technology extensively. Industries that are both highly labor-intensive and localized, such as construction, leisure, and hospitality, also tend to rank lower in usage, notably in the way they conduct customer transactions.

Lagging sectors could experience catch-up growth if the long tail of smaller and less digitized businesses begins to close the gap with leading companies. Thousands of small retailers have few if any digital operations beyond accepting credit cards, for example, in striking contrast with Amazon, Walmart, or Zappos. In manufacturing, many smaller firms use only basic enterprise software for administration, and they are years behind the largest aerospace or machinery manufacturers in their use of analytics.

[2] *Consumers driving the digital uptake: The economic value of online advertising-based services for consumers,* IAB Europe, September 2010.

Exhibit E2

The MGI Industry Digitization Index

2015 or latest available data

Sector	Overall digitization[1]	Assets: Digital spending	Assets: Digital asset stock	Usage: Transactions	Usage: Interactions	Usage: Business processes	Usage: Market making	Labor: Digital spending on workers	Labor: Digital capital deepening	Labor: Digitization of work	GDP share %	Employment share %	Productivity growth, 2005–14[2] %
ICT											5	3	4.6
Media											2	1	3.6
Professional services											9	6	0.3
Finance and insurance											8	4	1.6
Wholesale trade											5	4	0.2
Advanced manufacturing											3	2	2.6
Oil and gas											2	0.1	2.9
Utilities											2	0.4	1.3
Chemicals and pharmaceuticals											2	1	1.8
Basic goods manufacturing											5	5	1.2
Mining											1	0.4	0.5
Real estate	●										5	1	2.3
Transportation and warehousing	●										3	3	1.4
Education	●										2	2	-0.5
Retail trade	●										5	11	-1.1
Entertainment and recreation											1	1	0.9
Personal and local services											6	11	0.5
Government	●										16	15	0.2
Health care											10	13	-0.1
Hospitality	●										4	8	-0.9
Construction											3	5	-1.4
Agriculture and hunting											1	1	-0.9

1. Knowledge-intensive sectors that are highly digitized across most dimensions
2. Capital-intensive sectors with the potential to further digitize their physical assets
3. Service sectors with long tail of small firms having room to digitize customer transactions
4. B2B sectors with the potential to digitally engage and interact with their customers
5. Labor-intensive sectors with the potential to provide digital tools to their workforce
6. Quasi-public and/or highly localized sectors that lag across most dimensions

1 Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics); see technical appendix for full list of metrics and explanation of methodology.
2 Compound annual growth rate.

SOURCE: BEA; BLS; US Census; IDC; Gartner; McKinsey social technology survey; McKinsey Payments Map; LiveChat customer satisfaction report; Appbrain; US contact center decision-makers guide; eMarketer; Bluewolf; Computer Economics; industry expert interviews; McKinsey Global Institute analysis

The standard for what it means to be highly digitized today will be outdated tomorrow, and the digital leaders never stop devising new ways to use technology. Across every indicator in the index for which historical data is available, we compare the most digitized sector with the rest of the economy. This provides a proxy for understanding the size of the gap between the digital "haves" and "have-mores." We find that most sectors were only 12 percent as digitized as the leaders in 2005. Despite a massive rush of adoption and change since then, the rest of the economy was operating at only 14 percent of the leaders' digital capacity in 2013 (Exhibit E3).

18%
share of its digital potential that the US economy is actually realizing

The "have-mores" continue to push the boundaries of digitization, particularly in terms of augmenting what their workers do, while everyone else scrambles to keep up with them. This gap points to substantial room for much of the economy to boost productivity. In fact, since some of the lagging sectors are the largest in terms of GDP contribution and employment, we find that the US economy as a whole is reaching only 18 percent of its digital potential (defined as the upper bounds of digitization in the leading sectors).

The index results raise the question of why some sectors went digital sooner and more decisively than others. Four factors shape those outcomes: firm size, complexity of operations, knowledge intensity, and the threat of competition. Large firms are more likely to adopt digital tools than small firms (with the exception of small "digital natives"), in part to manage greater complexity. For a similar reason, firms with long supply chains or many establishments are also more likely to digitize. Companies with a large share of highly educated or specialized workers also tend to be more digitized since the productivity returns tend to be higher. Finally, the actual degree of competition in a sector does not seem to be a factor, but the *prospect* of competition is. Many firms digitized around the time their industries were deregulated. The digital leaders are the firms that have achieved this transformation more rapidly and effectively than their competitors, and this gap is changing the dynamics across various industries.

AS COMPANIES DIGITIZE, THE SPILLOVER EFFECTS ARE TRANSFORMING INDUSTRY STRUCTURES, PROFITABILITY, AND COMPETITION

Going digital is an opportunity to reinvent core processes, create new business models, and put the customer at the center of everything. Companies are using digital tools to raise the bar in operational efficiency, customer engagement, innovation, and workforce productivity. But there is wide variation in how aggressively and effectively they are pursuing these opportunities. A recent McKinsey survey of 150 large companies evaluated respondents on 18 practices related to digital strategy, capabilities, and culture to arrive at a metric called the Digital Quotient—and the distribution curve illustrates the striking gap between the digital leaders and laggards (Exhibit E4).

When digitization reaches critical mass across industries, it can spark fierce price competition, shifting profits, and competitive churn across commercial ecosystems. Many industries are experiencing more than one of the dynamics described below, and even those that have been unaffected so far have to brace themselves. Disruption could hit anywhere as new technologies, business models, and competitors appear with incredible speed.

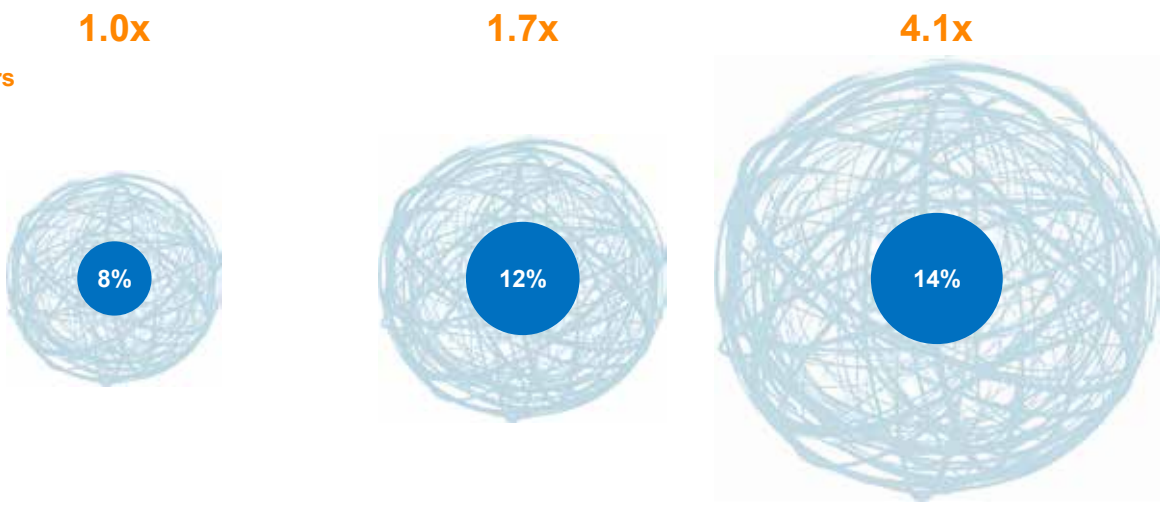
Exhibit E3

The most digitized sectors are maintaining a considerable lead over the rest of the US economy

Extent of digitization, 1997, 2005, and 2013[1]
Index: 1x = most digitized sectors in 1997

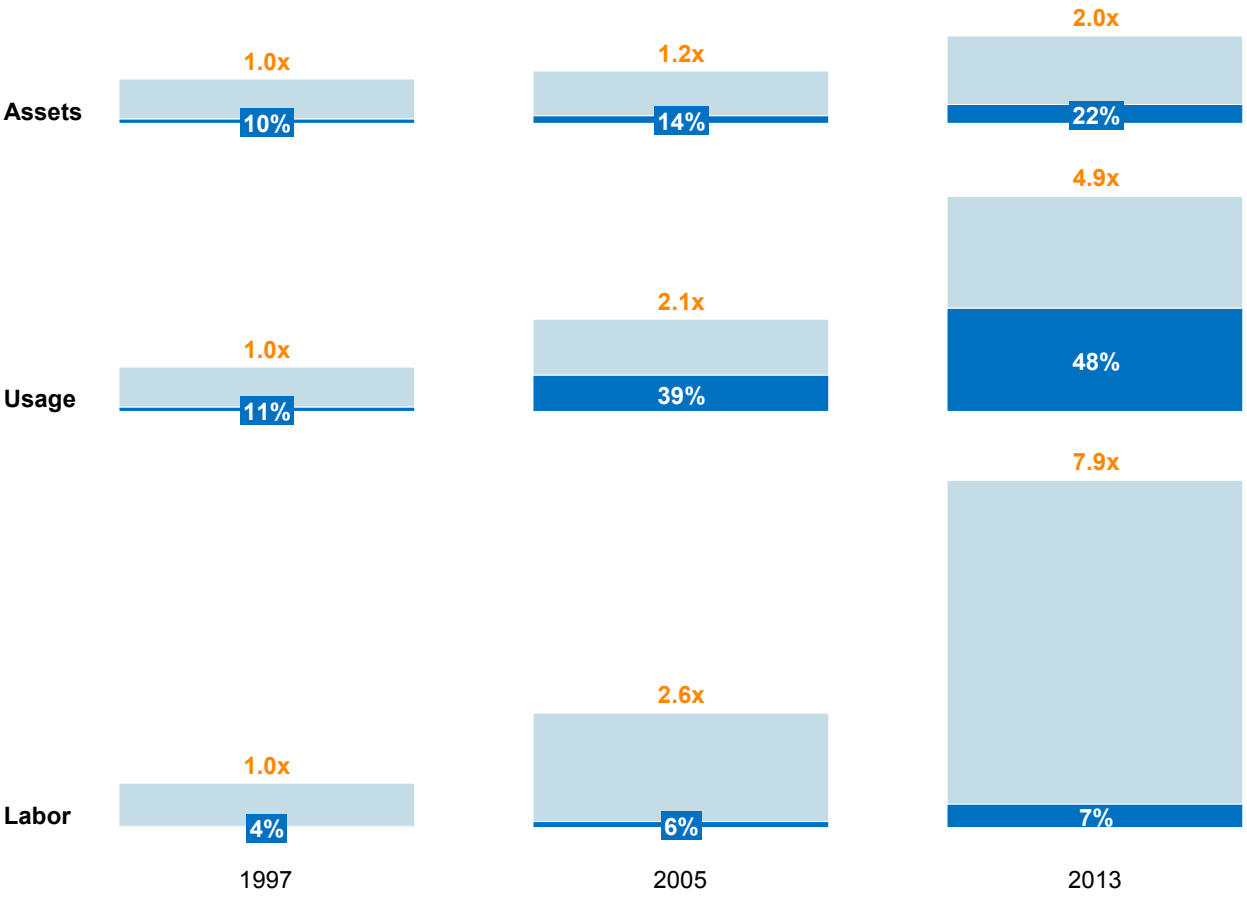
Most digitized sectors
Rest of US economy, relative to leading sectors

Overall digitization of leading sectors



The leading sectors have increased their digital intensity four-fold since 1997, with the greatest gains coming in the past decade. Other sectors are barely keeping pace.

Growth in the most digitized sectors



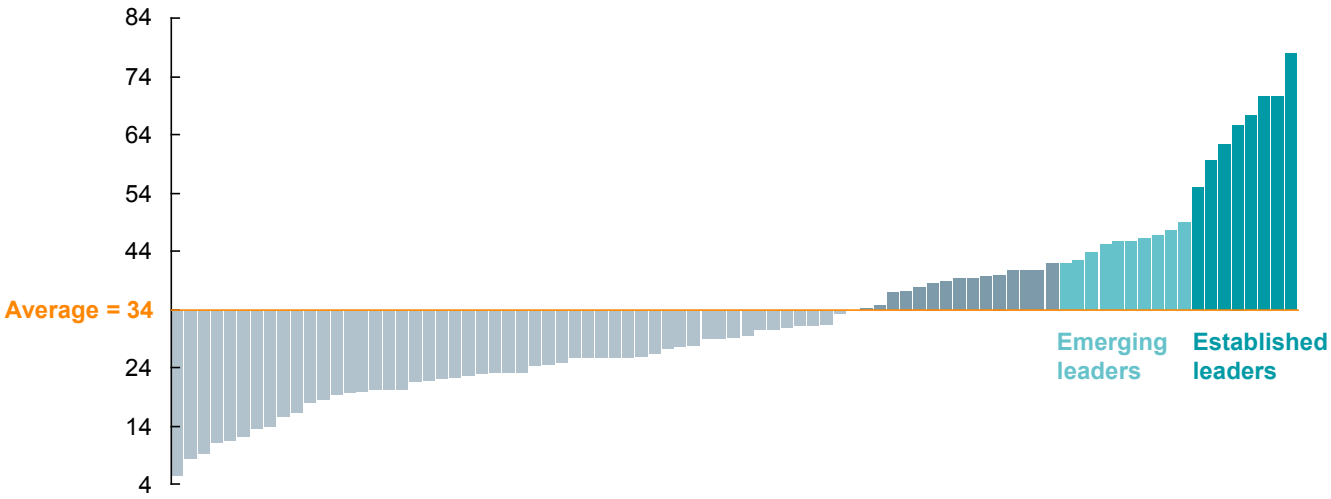
1 Measured using a set of 18 historical metrics spanning assets (6 metrics, including spending on digital assets and the stock of digital assets), usage (6 metrics, including digital transactions), and labor (6 metrics, including digital capital deepening).

SOURCE: BLS; BEA; McKinsey social technology survey; McKinsey Digital Payments Map; Gartner; ARP Research; DMA; eMarketer; McKinsey Global Institute analysis

Exhibit E4

Among large corporations, digital maturity varies widely—with a large gap between digital leaders and the rest

Digital Quotient score



SOURCE: 2014-15 McKinsey Digital Quotient company survey; "Raising your Digital Quotient," *McKinsey Quarterly*, June 2015

Digital assets determine competitive advantage

Competitive dynamics are increasingly determined by who develops the right digital assets.[3] Sectors such as media are moving from physical to digital products, and companies in all types of industries are building massive data repositories. Among the most prized assets are digital platforms, such those created by Facebook, iTunes, eBay, Amazon, LinkedIn, and Airbnb. Even beyond these well-known examples, companies in traditional sectors are beginning to focus on data, platforms, and connectivity as the key to interactions, transactions, and innovation. Consider the automotive industry, where digital platforms have transformed the customer decision journey. Consumers now save time and money by searching and comparing vehicles online before they make a purchase—and their online activity leaves a data trail that dealers can use to identify selling opportunities. Technology is also embedded within the physical product: cars now feature GPS and next-generation safety systems, maintenance alerts, Bluetooth connectivity, and entertainment systems. Tesla has pioneered some of the most sophisticated connected cars to date, using wireless software downloads to add new features and fixes—and now even self-driving capabilities—to existing cars.

Information becomes widely available, disrupting traditional intermediaries

In consumer-facing markets, digitization produces lower search and transaction costs, better matching of products to preferences, and greater transparency. A user can compare prices, features, service, and product satisfaction with a few clicks of a mouse. In addition to creating pricing pressures, this has consequences for middlemen, as digital platforms can replace localized, physical intermediaries and capture market power. In the hospitality sector, travel sites such as Expedia or Priceline allow users to instantly search, compare, and assemble the components of a trip, and they have cut into the fragmented network of travel agents that once brokered many transactions. From 2000 to 2014, online hotel booking revenue increased tenfold, but the number of US travel agents fell by 48 percent. Value is shifting from physical intermediaries and asset holders (including not only travel agents but also hotel owners themselves) to digital intermediaries and to consumers. This

[3] Jacques Bughin and James Manyika, "Measuring the full impact of digital capital," *McKinsey Quarterly*, July 2013.

shift could accelerate as information about both providers and consumers forms the basis of new digital marketplaces. By bringing together travelers with individual property owners who want to list their spare rooms or rental properties, platforms such as Airbnb, VRBO, Flipkey, and HomeAway monetize assets that might otherwise sit empty.

Value chains break apart, creating openings for specialization and new competitors

Digitization allows companies to split jobs into smaller and more specialized tasks to become more efficient.[4] Something similar happens at the industry level, as producers are better able to create specialized offerings for small markets within the ecosystem. In health care, for example, companies are going after very specific segments, as ZocDoc has done with scheduling. In financial services, the investment advisory business has become disaggregated, and small registered personal advisers, many of whom use "plug-and-play" systems, are the fastest-growing segment. Large retail banks similarly face a growing array of small, tech-enabled challengers in specific markets, from credit (NerdWallet, Credit Karma) and loans (Avant, Upstart) to personal financial management (Mint.com, BillGuard).

Low marginal costs and network effects create hyperscale advantages

In the pre-digital era, economies of scale were usually achieved by building large networks of factories or amassing equipment. While physical processes have marginal costs, digital platforms make the cost of doing one more transaction or creating one more peer-to-peer connection trivial, giving digital companies a distinct advantage. The combination of low-marginal-cost economics and platform architecture has allowed the most successful high-tech firms to achieve a scale that was once impossible—and to do so in record time. Facebook was launched in 2004; a decade later, its monthly active users outnumber the population of China. The power of platform economics is reflected in the gross margins enjoyed by software companies, which can run as high as 80 percent, the highest of any industry. Controlling a general-use platform allows companies to become primary digital touch points for millions of people. It gives them access to an extensive amount of data on their users, which can lead to yet more capabilities being added to the platforms.

Industry boundaries become blurred

Once digital players have established themselves as leaders in one market, they have a striking ability to move into new areas. Amazon went from selling books to adding virtually every retail category; later it created its own self-publishing platform and began to offer cloud-based business services. Tech firms are making forays into the automotive industry. Not only are they partnering with traditional manufacturers to integrate "infotainment" platforms into vehicles, but firms such as Google are even developing their own self-driving cars. In fact, Google has added so many wide-ranging ventures over the years that it recently split its core Internet search operations from its other ventures, which include longevity and biotech research, smart home products, venture capital investing, and high-speed Internet fiber services. Having already disrupted the traditional taxi industry, Uber has launched a food delivery service, UberEats, in several cities across the country. And Salesforce.com has teamed up with Philips to introduce a cloud-based health platform that can remotely monitor patients with chronic diseases.

DIGITIZATION CREATES HUGE BENEFITS FOR CONSUMERS AND MORE COMPLEX EFFECTS ON GROWTH AND EMPLOYMENT

The cumulative effect of digitization is felt across the entire economy. Consumers have captured a huge range of benefits, both tangible and intangible. But the productivity effect requires a nuanced view, and there are negative implications for employment and wages.

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[4] *An economy that works: Job creation and America's future*, McKinsey Global Institute, June 2011. See also Thomas W. Malone, Robert Laubacher, and Tammy Johns, "The big idea: The age of hyperspecialization," *Harvard Business Review*, July-August 2011.

Digitization produces significant benefits to consumers and society

Consumers have been big winners in the digital economy, although most of this effect does not show up as GDP. The spread of smartphones has put vast computing power in their pockets. They can instantly sort through the entire store of human knowledge or access an endless stream of content and communication on social media—all for free.

Digital marketplaces create intense price competition. Consumers can hold out for bargains and get exactly what they want when they want it. Publicly posted user reviews can arm them with better information, heightening the pressure on businesses to provide quality and service. In addition, some tech firms are providing free products or services where traditional businesses once charged fees. In these cases, the consumer gains are siphoning value out of industries.

The annual benefits to consumers are enormous. Estimates vary from $5 billion to over $100 billion per year, in part because studies have approached this question in different ways.[5] Newer forms of surplus, from GPS navigation to personal financial tools, push this even higher. And beyond the consumer, the US economy has gained through better societal outcomes. Technology is fueling progress in areas from public spending and infrastructure to health care and education, although much more can be achieved in all of these domains.

Digitization has contributed to rapid GDP and productivity growth in the past, but recent gains are blurred

In the late 1980s, digital adoption grew in many sectors, and productivity growth soon followed. Total productivity growth among US businesses averaged only about 0.7 percent per year between 1975 and 1995, but over the next decade, it rose to an annual average of 1.6 percent, increasing nearly 2.5 times as fast as in the preceding 20 years.[6] These gains can be attributed at least in part to increased business investment in ICT tools, as the most digitized sectors (including the ICT sector itself) posted some of the largest productivity gains. This productivity surge was reflected in GDP growth, which averaged nearly 4 percent per year in real terms during this period, compared with 3.3 percent in the previous decade.

But after 2005, these effects vanish from the measured statistics. Total productivity growth has fallen by two-thirds since 2005, while real GDP growth has averaged about 2 percent per year—all during a period in which the digital economy has continued to grow. This new "Solow's paradox" phenomenon has led some to posit that the revolutionary nature of digital technologies has been overhyped.[7]

Moreover, the nature of productivity growth has also changed in the past decade. By definition, productivity growth stems either from improving efficiency (that is, reducing the inputs needed to produce a given output) or from increasing the volume and value of outputs relative to any given input. The productivity surge of the late 1990s reflected both of these factors. Firms in large sectors such as retail, wholesale, and financial services made ICT investments while simultaneously making innovative changes to business processes, organization, and management.[8] They not only became more efficient but were able to capitalize on strong GDP and demand growth as a result. In contrast, sectors that posted

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5 Across multiple studies, estimates based on time use tend to converge around $100 billion per year; monetary estimates converge around $5 billion per year; and willingness-to-pay estimates are in the middle of this range.

6 This refers to multifactor productivity growth in the non-farm business sector. Annual labor productivity growth shows similar trends; it grew at 1.8 percent from 1975 to 1995 and surged to 3 percent between 1995 and 2005.

7 Robert J. Gordon, "US productivity growth: The slowdown has returned after a temporary revival," *International Productivity Monitor*, number 25, spring 2013; and Tyler Cowen, *The great stagnation: How America ate all the low-hanging fruit of modern history, got sick, and will eventually feel better*, Dutton, 2011.

8 *US productivity growth: 1995–2000*, McKinsey Global Institute, October 2001.

the greatest productivity growth in the 2000s substantially reduced employment.[9] Some of these sectors, such as ICT and media, have highly digitized workforces.

Multiple factors may explain why measured productivity during the past decade has been less than stellar despite the digital innovations all around us. First, economic statistics do not reflect the full benefits of those innovations in the lives of consumers. Many tech firms provide valuable services to consumers for free from day one, and the benefits grow over time with rapid adoption—not from consumer price declines that are more easily measured. Statistics are not capturing an important and innovative part of the economy because the productivity advance flows to unmeasured consumer surplus. Consumer surplus has always been present, but the use of free digital platforms such as Google for search, Wikipedia for information, and Facebook for instant communication has expanded dramatically in the past decade. Estimates of this new wave of consumer surplus vary widely, but some are as high as 0.7 percentage points of annual GDP growth.[10]

Second, historical methods for estimating the real prices of ICT products may not adequately account for their expanding capabilities or for changes in pricing strategy within the ICT sector. Recent research argues that it is difficult for data to capture quality improvements and innovation in digital content and new capabilities in subsequent generations of advanced software.[11] This is a crucial point, since ICT and ICT-intensive industries contributed two-thirds to three-quarters of productivity growth between 1995 and 2005 and posted some of the steepest declines in measured productivity over the past decade.[12]

Finally, as digital technologies have made big leaps in capabilities in recent years, many companies have expanded their digital assets and usage. But it can take several years for large firms (and whole sectors) to make the many organizational and operational changes necessary to capture the full benefits of ongoing digital investments.[13] Today, for instance, some firms are already realizing the benefits of investing in the Internet of Things, but many others are grappling with issues such as interoperability, the difficulty of retrofitting legacy assets, cybersecurity, and data privacy issues. As with previous rounds of ICT-enabled productivity, it may take years for these types of issues to be resolved across entire sectors. Eventually, as large companies and broader value chains make the associated improvements in processes, organizational structures, supply chains, and business models, the effects could become substantial enough to register as sector-level and finally economy-wide productivity gains.[14]

Digitization polarizes the labor market, but can help to address some of its inefficiencies

It is difficult to tease out the impact of digitization from other trends that influence job creation, such as recessions and offshoring. But some effects are apparent. Previous MGI research found that digitization has contributed to increasingly jobless recoveries from recessions. The postwar US economy took roughly six months to recover lost jobs

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9 *Growth and renewal in the United States: Retooling America's economic engine*, McKinsey Global Institute, February 2011.

10 Erik Brynjolfsson and Joo Hee Oh, "The attention economy: Measuring the value of free digital services on the Internet," 33rd International Conference on Information Systems, 2012.

11 See Jan Hatzius and Kris Dawsey, "Doing the sums on productivity paradox v2.0," Goldman Sachs, US Economics Research, issue number 15/30, July 2015. See also David Byrne, Stephen Oliner, and Daniel Sichel, *How fast are semiconductor prices falling?* NBER working paper number 21074, April 2015.

12 John Fernald and Bing Wang, "The recent rise and fall of rapid productivity growth," Federal Reserve Bank of San Francisco, *FRBSF Economic Letter,* February 2015. Also see Bart van Ark et al., *Prioritizing productivity to drive growth, competitiveness, and profitability,* The Conference Board, 2015.

13 Erik Brynjolfsson and Lorin M. Hitt, "Computing productivity: The firm-level evidence," *Review of Economics and Statistics*, November 2003.

14 Martin N. Baily and James Manyika, "Reassessing the Internet of Things," Project Syndicate, August 2015; also see Michael Spence, "Automation, productivity, and growth," Project Syndicate, August 2015.

after every recession. But it took 15 months to restore lost jobs after the 1991 recession, 39 months after 2001, and 43 months after 2008. Large companies in particular now respond to downturns with a push to improve productivity—not by increasing output and innovation but by cutting employment. As discussed above, this approach distinguished the productivity gains of the 1990s from those of the 2000s. Changes such as automation tend to become permanent, as MGI found in a 2011 survey of 2,000 US companies.[15] As a result, slowdowns now tend to hit employment hard even as productivity is unaffected.

19%
share of US employment in the most digitized sectors

Digitization has also contributed to hollowing out the middle-skill portion of the US workforce. Since 2000, the United States has created eight million net new full-time-equivalent positions; two-thirds of those have been in low-skill interactive work and the remaining one-third in high-skill interactive work. But some 2.5 million net production and transaction positions were lost during this period. Robots have supplanted assembly line workers, and software handles many of the tasks once performed by bookkeepers, secretaries, and file clerks.

In terms of wages, digitization may have accelerated a divergence between the majority of workers and a smaller group at the top.[16] The most digitized industries have posted the fastest wage growth, but they make up only about 19 percent of total US employment; digitized companies are able to generate more output and capture more profit with fewer employees. Meanwhile, average hourly wages have stagnated in real terms. Since 1980, labor productivity has grown 2.5 times faster than wages, breaking historical patterns.

However, the digital shift has had some positive effects on jobs, including the creation of new occupations that did not exist before. It also raises the prospect of using online platforms to improve the way the labor market functions (see the projection below). These platforms are already giving individual workers more mobility. Over time, their ability to aggregate data about the skills that are in demand can help individuals map out education and career pathways. The common thread running through all of these changes is that skills and continuous learning matter more than ever.

BY 2025, THREE EFFECTS OF DIGITIZATION ALONE COULD BOOST GDP BY UP TO $2.2 TRILLION—BUT THE POSSIBILITIES ARE MUCH WIDER

We consider the impact on future economic growth by focusing on three areas: the labor market, capital efficiency, and multifactor productivity. Much of this potential stems from innovations that are already percolating through the economy and could soon return large dividends. But these are just three examples of the many avenues for digitization to generate growth. The digital frontier shows no sign of slowing, and we have barely scratched the surface of the many markets that could be transformed.

First, online talent platforms could make the US labor market more efficient and transparent. As these platforms grow in scope, their ability to accelerate job searches could lower the equilibrium unemployment rate, while better job matches could have a positive effect on productivity. New digital marketplaces for services are also creating flexible work opportunities that could boost labor force participation. Prior MGI research has estimated that these effects could add $500 billion to annual GDP by 2025.[17]

Second, the Internet of Things (IoT) can improve the utilization of fixed assets. Industries with extensive machinery and factories are beginning to install IoT systems but are only at

[15] *An economy that works: Job creation and America's future*, McKinsey Global Institute, June 2011.

[16] Daron Acemoglu and David Autor, "Skills, tasks and technologies: Implications for employment and earnings," in *Handbook of Labor Economics*, volume 4, part B, Orley Ashenfelter and David Card, eds., Elsevier, 2011; David Autor, *Polanyi's paradox and the shape of employment growth,* NBER working paper number 20485, September 2014.

[17] *A labor market that works: Connecting talent with opportunity in the digital age*, McKinsey Global Institute, June 2015.

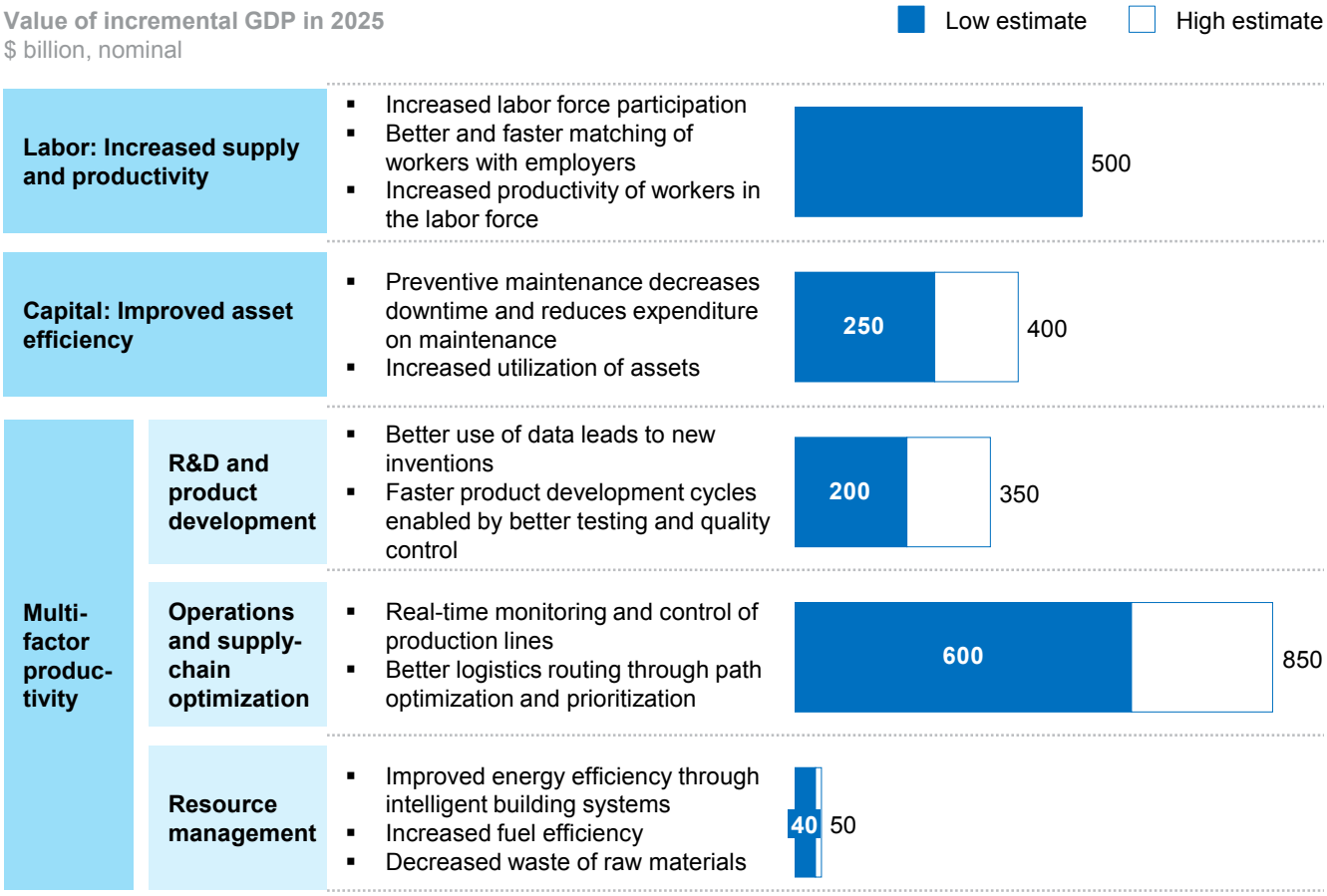
the beginning of exploiting the data they collect. Manufacturers, for example, can reduce downtime in factories with applications that signal when machinery needs preventive maintenance, while the use of sensors can boost recovery on oil rigs.[18] Improved asset efficiency could add $250 billion to $400 billion to annual GDP by 2025.

Third, companies that are investing in big data analytics and IoT technologies are still learning how to get the most out of these tools in their operations. This may involve managing the movement of costly supplies, machinery, and labor around complex worksites, or improving supply chain logistics. Mobile systems can connect employees in the field, while intelligent systems in office buildings can reduce energy use. We estimate that continued innovation in product development, operations and supply chains, and resource management could produce $900 billion to $1.3 trillion in annual GDP impact.

These impacts on labor, capital, and multifactor productivity alone could generate a combined annual impact of $1.6 trillion to $2.2 trillion by 2025 (Exhibit E5). This would lift GDP 6 to 8 percent above baseline projections for that year.

Exhibit E5

By 2025, three effects of digitization alone could boost annual US GDP by up to $2.2 trillion


Value of incremental GDP in 2025
$ billion, nominal
Low estimate
High estimate
Labor: Increased supply and productivity
Increased labor force participation
Better and faster matching of workers with employers
Increased productivity of workers in the labor force
500
Capital: Improved asset efficiency
Preventive maintenance decreases downtime and reduces expenditure on maintenance
Increased utilization of assets
250
400
Multi-factor produc-tivity
R&D and product development
Better use of data leads to new inventions
Faster product development cycles enabled by better testing and quality control
200
350
Operations and supply-chain optimization
Real-time monitoring and control of production lines
Better logistics routing through path optimization and prioritization
600
850
Resource management
Improved energy efficiency through intelligent building systems
Increased fuel efficiency
Decreased waste of raw materials
40
50

These opportunities alone could add $1.6 trillion to $2.2 trillion to annual GDP by 2025. However, this sizing is not comprehensive and only reflects the applications we have analyzed in this report. The potential for technology-fueled growth is much wider.

NOTE: Numbers may not sum due to rounding.

SOURCE: McKinsey Global Institute analysis

[18] For more on IoT technologies, their applications in various settings, and their economic potential, see *The Internet of Things: Mapping the value beyond the hype*, McKinsey Global Institute, June 2015.

Beyond the direct GDP impact, digitization also supports growth in more indirect ways. One of these is deepening US ties with the global economy as digital goods and services, digital platforms, and tracking technologies enable trade. And even more profound than the economic gains are the societal benefits digitization could deliver as it continues to penetrate the public and quasi-public sectors. Big data analytics in health care and government could produce some $150 billion to $300 billion in cost savings—and even bigger returns in the form of health, more effective public services, and improved quality of life.

AUTOMATION COULD REDEFINE MANY OCCUPATIONS AND ACCELERATE HISTORICAL RATES OF MIDDLE-SKILL JOB DISPLACEMENT

Historically, technological advances have usually created net jobs, but some argue that this time things are different.[19] Indeed, technology is beginning to encroach on human skills in ways once only written about in science fiction. As technology advances, there is growing anxiety about job losses, but it is important to consider that technology creates the need for new roles even as it renders others redundant. Two decades ago, occupations such as app developer, social media manager, SEO specialist, and big data analyst were not on the radar. Because many factors are in play, we do not attempt to quantify the impact of automation on net job creation. In the near future, some jobs will evolve, some will be eliminated, and others may be created—including, perhaps, entirely new roles that we cannot predict today.

Automation affects human work through its impact on individual activities and tasks, and we consider it through this lens. Some 60 percent of occupations could have 30 percent or more of their activities automated. This will affect skill requirements and the day-to-day nature of work for a large share of the labor force.[20] As companies in many industries integrate these technologies, jobs and business processes will be redefined on a large scale. Workers of all skill levels, including highly skilled professionals, will not be immune.

2x
potential increase in historical job displacement rate over the next decade

To illustrate what could unfold over the next decade, we take a closer look at the potential impact on middle-skill occupations such as clerical, sales, production, and operational roles—a segment of the workforce that has already experienced increasing job displacement over the past two decades. After analyzing a detailed list of tasks performed by these workers, we consider which ones could be automated by currently demonstrated technologies. We then map these tasks to jobs to estimate the share of employment that would be affected, applying historical adoption rates of comparable technologies. This approach considers only what is possible from a technological perspective, not whether this shift will be economically viable. Based on different adoption curves, we find that automation could displace anywhere from 10 to 15 percent of these jobs in the decade ahead. The median point of our scenario is 13 percent, which would represent a sharp acceleration of historical displacement rates (Exhibit E6).[21]

Automation is likely to lead to the creation of new products and services. Over the medium to long term, if displaced workers acquire the capabilities and training they need for new roles, the overall productivity of the US labor force could increase. But in the short term, this could be a wrenching shift for many workers.

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19 Erik Brynjolfsson and Andrew McAfee, *Race against the machine*, Digital Frontier Press, 2011.

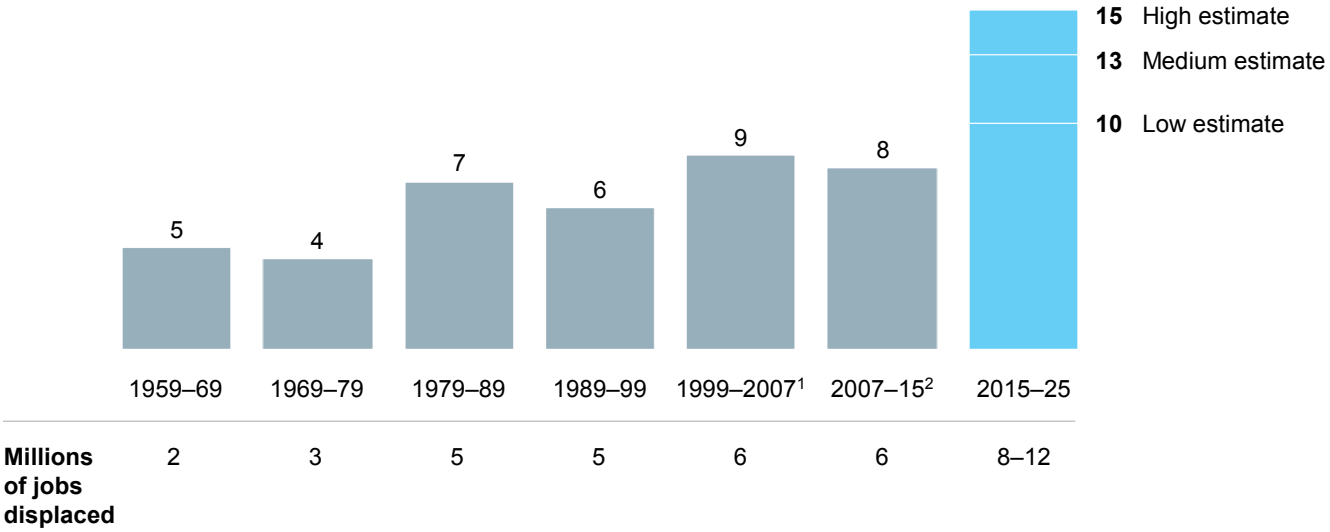
20 For more on this issue and the underlying analysis, see Michael Chui, James Manyika, and Mehdi Miremadi, "Four fundamentals of workplace automation," *McKinsey Quarterly*, November 2015. Some 45 percent of work tasks can be automated with currently demonstrated technologies.

21 These historical displacement rates are based on Daron Acemoglu and David Autor, "Skills, tasks and technologies: Implications for employment and earnings," in *Handbook of Labor Economics*, volume 4, part B, Orley Ashenfelter and David Card, eds, Elsevier, 2011.

Exhibit E6

Automation could accelerate the displacement of middle-skill jobs to nearly twice the rate of recent decades

Share of middle-skill jobs displaced in the US economy
%



1 Normalized to 10 years and adjusted for the 2008 recession.
2 Extrapolated 2015 total and middle-skill employment based on trends through 2014.

SOURCE: BLS; O*NET; Katz and Margo, 2013; Acemoglu and Autor, 2010; Brancheau and Wetherbe, 1990; McKinsey Global Institute analysis

COMPANIES HAVE TO ADAPT TO SURVIVE IN THE DIGITAL ECONOMY

Going digital can be daunting for large companies in more traditional, physical industries, and for SMEs that already find it challenging to attract talent and to invest. It demands a high level of coordination and a whole new set of capabilities. Conversely, this is an empowering moment for entrepreneurs; the barriers to entry have never been lower. The list below outlines some of the most pressing issues for companies in the areas of competition, customer engagement, and operations.

- **Prepare for tougher, 360-degree competition.** Geographic and sector boundaries mean very little in a more digital world. New competitors that look nothing like traditional industry leaders can become market leaders practically overnight. In particular, the pooling of thousands of small players in the largest marketplaces and ecosystems, such as small Chinese manufacturers on Alibaba, represents a new competitive force. Many of these small enterprises have the advantage of being "born digital." Unburdened by legacy systems, they build digital into their business models from the outset rather than retrofitting it onto existing processes.

- **Build new assets and revenue streams.** Digital disruptors have often destroyed more value for incumbents than they have created for themselves, giving many of the benefits away to consumers. This trend may continue and even spread to additional industries. Companies have to figure out how to capture some of that surplus and create more sustainable business models. Businesses need to build a strong digital balance sheet, considering whether assets such as behavioral data or customer relationships could be monetized. Portfolio strategies can be a valuable hedge in such a fast-moving environment; businesses that rely too heavily on a single revenue stream or on playing an intermediary role in a given market are particularly vulnerable.

- **Build—or buy—the capabilities of the future.** In this competitive landscape, companies cannot afford to fall behind in critical capabilities. Some can be cultivated by establishing the right talent pipeline or building new business lines using existing resources. But sometimes companies need speed, and finding an outside partner with complementary strengths may make sense. Some larger players are turning to acquisitions to expand their portfolios and add new capabilities, talent, or a built-in user base. M&A is increasingly becoming a "land grab" as companies attempt to head off their future competitors by buying them. Some recent deals would not pass the traditional valuation filter, but the need to execute a rapid strategy, acquire high-value intellectual property, and stay on the cutting edge may call for different metrics.

- **Redefine customer engagement.** Companies can harness the data they generate from digital interactions to fine-tune marketing and customer engagement. Design is also playing a more central role in business strategy and product development; it can be critical to standing out in a noisy digital world with a multitude of distractions. As the largest platforms solidify their positions as customer gateways, many companies are forced to sell their products or services in someone else's ecosystem. That calls for careful strategies around pricing, value retention, and brand integrity.

- **Take advantage of new innovation models.** Data-sharing initiatives, crowdsourcing, and virtual collaboration can make R&D more productive. Companies are replacing closed and rigid R&D operations with more open processes involving teamwork across the organization and the supply chain. Users, too, can be engaged in co-creating brands and products. Creative partnerships may make sense so that companies from different sectors can bring distinct capabilities to technology projects. New technologies may also require cooperation with competitors and industry groups to set common standards; this is a major issue in the development of the Internet of Things and electronic medical records.

- **Emphasize agility and learning over forecasting and planning.** As technology-driven change continues to accelerate, long-term forecasting exercises are less relevant and reliable. But agility is more critical than ever. Large incumbents can't afford cumbersome decision-making processes and inertia. Borrowing a page from winning tech firms, they need a mindset focused on learning, experimenting, and iterating.

- **Think differently about your workforce.** The rapid-fire pace of technology means that companies are constantly in need of the latest skills. Investing in learning programs that allow proven employees to grow may make more sense than perpetually recruiting. Now that online hiring platforms make it easy for competitors to poach top talent, companies have to create growth opportunities and other incentives for valued employees to stay. Beyond the hiring process, leading companies are beginning to apply new types of technology tools to the goal of boosting workforce productivity.

POLICY CHALLENGES INCLUDE BUILDING PHYSICAL AND REGULATORY INFRASTRUCTURE AS WELL AS HELPING THE WORKFORCE TRANSITION

Governments have a dual challenge. In addition to setting policy, they have significant potential to digitize their own operations. South Korea, Singapore, Australia, France, the Netherlands, and Japan outscore the United States in the latest United Nations survey of e-government services, in part because the quality and extent of these services varies widely across US federal agencies and state and local governments. There is tremendous scope to deploy big data analytics in functions from procurement to tax collection and the administration of public benefits. Continuing to digitize can improve public-sector productivity and make government more transparent, responsive, and cost-effective. Policy makers can also harness digital technologies to improve societal outcomes in areas such as health care, education, and infrastructure.

- **Encourage participation.** The digital divide may be narrowing, but it still has to be bridged in order to connect the Americans who remain offline and are being bypassed by the digital economy. A crucial part of this is ensuring that the United States matches leading countries in coverage, download speeds, and affordability. But encouraging participation is about more than providing access and infrastructure; it is about enhancing digital literacy, increasing awareness of digital tools, and encouraging their adoption by consumers and workers. Government can also help entrepreneurs and small business owners develop exporting capabilities to boost their participation in global platforms and flows. Just as digital capabilities shape competition at the company and sector level, they also matter for national competitiveness in an interconnected—and increasingly digital—global economy.[22]

- **Set the rules of the game, but be prepared to learn and adapt.** Building a comprehensive policy framework will require attention to evolving issues such as privacy, data sharing, and industry concentration. Policy makers can also facilitate the development of common standards in areas such as medical data and the Internet of Things to create the foundation for innovation. Even more fundamentally, however, policy making for a more digital economy requires a new mindset. Regulatory bodies tend to presume that the rules they set will provide stability and clarity over the long term. But we are moving into uncharted territory. Ongoing innovation calls for a test-and-learn approach to policy.

- **Help individuals navigate the transition.** Policy makers cannot fend off automation, but they can support those who are affected and build the institutions and training pathways needed in a more digital economy. The first major area for action is skills development. Many of those already in the workforce will need access to short, concentrated training programs for acquiring new skills. In the longer term, there is an enormous opportunity to use the data now at our disposal to design a more effective and responsive system for education and training. Another major focus area is worker protections. If digital platforms for freelancers and on-demand service workers continue to expand, policy makers will need to clarify how project-based workers are treated under the law and consider how to modernize the system for delivering benefits.

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Keeping up with the relentless pace of digital innovation is both a sprint and a marathon. Individuals will have to keep developing their skills throughout their working lives and adjust to a fast-changing job market. Governments will have to build new capabilities if they hope to deliver public services more effectively and capture potential cost savings. Digitization is a gift to startups, disruptors, and small businesses—but an existential challenge for established companies. There is no room for inertia on the digital frontier. It takes investment, agility, and relentless focus to stay ahead, but the organizations and individuals that can establish themselves as digital leaders can find outsized opportunities.

[22] See *Global flows in a digital age: How trade, finance, people, and data connect the world economy,* McKinsey Global Institute, April 2014, as well as upcoming MGI research into digitization and globalization.

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